1904

SEVENTEENTH ANNUAL REPORT

OF THE

South Carolina Experiment Station,

OF THE

CLEMSON AGRICULTURAL COLLEGE,

FOR THE YEAR ENDING

DECEMBER 31, 1904.

COLUMBIA, S. C.
THE STATE COMPANY, PRINTERS.
1905.

SEVENTEENTH ANNUAL REPORT

OF THE

South Carolina Experiment Station,

OF THE

CLEMSON AGRICULTURAL COLLEGE,

FOR THE YEAR ENDING

DECEMBER 31, 1904.

COLUMBIA, S. C.
THE STATE COMPANY, PRINTERS.
1905.

BOARD OF TRUSTEES.

HON. R. W. SIMPSON, *President.*

SEN. B. R. TILLMAN.	HON. J. E. TINDAL.
HON. J. E. BRADLEY.	HON. JESSE H. HARDIN.
HON. R. E. BOWEN.	HON. G. DUNCAN BELLINGER.
HON. M. L. DONALDSON.	HON. W. D. EVANS.
HON. D. K. NORRIS.	HON. L. A. SEASE.
HON. J. E. WANNAMAKER.	HON. A. T. SMYTHE.

DR. P. H. E. SLOAN, *Secretary and Treasurer.*

BOARD OF FERTILIZER CONTROL.

HON. J. E. TINDAL.	HON. W. D. EVANS.
HON. J. E. WANNAMAKER.	H. M. STACKHOUSE, *Secretary.*

BOARD OF EXPERIMENT STATION CONTROL.

HON. J. E. TINDAL.	HON. M. L. DONALDSON.
HON. B. R. TILLMAN.	HON. A. T. SMYTHE.
HON. J. E. WANNAMAKER.	J. N. HOOK, *Secretary.*

OFFICERS OF EXPERIMENT STATION.

P. H. MELL, M. E., Ph. D., *President of College.*
J. S. NEWMAN, *Vice-Director and Agriculturist.*
M. B. HARDIN, *Chief Chemist.*
LOUIS A. KLEIN, D. V. M., *Veterinarian.*
C. C. NEWMAN, *Horticulturist.*
C. E. CHAMBLISS, M. Sc., *Entomologist.*
HAVEN METCALF, A. M., Ph. D., *Botanist and Bacteriologist.*
————————, *Dairy and Animal Husbandry.*

F. S. SHIVER, Ph. G., *Assistant Chemist.*
R. N. BRACKETT, Ph. D., *Assistant Chemist.*
C. C. MCDONNELL, B. S., *Assistant Chemist.*
B. F. ROBERTSON, B. S., *Assistant Chemist.*
D. H. HENRY, B. S., *Assistant Chemist.*
H. BENTON, M. S., *Assistant Agriculturist.*
B. H. RAWL, B. S., *Assistant Dairyman and Animal Husbandman.*
F. C. ATKINSON, B. S., *Assistant Chemist.*
J. S. PICKETT, *Foreman.*
JOHN N. HOOK, *Secretary and Librarian.*
MISS VIRGINIA NORRIS, *Stenographer.*

Mail and telegraph: Clemson College, S. C.

Freight and express: Calhoun, S. C.

The bulletins of the Station are issued at irregular intervals, and are sent free to all citizens of the State who apply for them.

CLEMSON COLLEGE, S. C., December 31, 1904.

Hon. D. C. Heyward, Governor of South Carolina.

Sir: I have the honor to submit herewith the Seventeenth Annual Report of the South Carolina Agricultural Experiment Station, in accordance with the requirements of an Act of Congress approved March 2, 1887, for the Establishment of Agricultural Experiment Stations in connection with the Colleges of the several States, organized under the provisions of an Act approved July 2, 1862.

Respectfully submitted.

P. H. MELL,
President.

THE SOUTH CAROLINA EXPERIMENT STATION IN ACCOUNT WITH THE UNITED STATES APPROPRIATION, 1903-1904.

DR.

To Receipts from the Treasurer of the United States as per appropriation for fiscal year ended June 30, 1904, as per act of Congress approved March 2, 1887 ..... $15,000 00

CR.

	Abstract.	
By Salaries	1	$8,753 88
Labor	2	1,527 56
Publications	3	1,131 33
Postage and stationery	4	102 55
Freight and express	5	153 83
Heat, light, water, and power	6	51 95
Chemical supplies	7	431 22
Seeds, plants, and sundry supplies	8	361 82
Fertilizers	9	142 46
Feeding stuffs	10	1,041 96
Library	11	60 49
Tools, implements, and machinery	12	330 42
Furniture and Fixtures	13	
Scientific apparatus	14	11 00
Live stock	15	
Traveling expenses	16	287 42
Contingent expenses	17	35 63
Buildings and repairs	18	576 48
Balance		
Total		$15,000 00

We, the undersigned, duly appointed Auditors of the Corporation, do hereby certify that we have examined the books and accounts of the Treasurer of South Carolina Experiment Station for the fiscal year ended June 30, 1904; that we have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to have been $15,000.00, and the corresponding disbursements $15,000.00; for all of which proper vouchers are on file and have been by us examined and found correct, thus leaving no balance.

And we further certify that the expenditures have been solely for the purposes set forth in the act of Congress approved March 2, 1887.

(Signed) R. W. SIMPSON,
[SEAL.] M. L. DONALDSON,
Auditors.

Attest:
P. H. E. SLOAN,
Custodian.

SOUTH CAROLINA AGRICULTURAL EXPERIMENT STATION, 1903-1904.—SUPPLEMENTARY STATEMENT.

[This supplementary statement, while not required by law, is desired as an aid in interpreting the account rendered for the United States appropriation. While it will be more useful if made in conformity with the schedule fixed for that appropriation, if this is not practicable such a summary of receipts and expenditures from the sources indicated below as can be conveniently prepared from the books of the station may be substituted. Whenever practicable, it should be for the fiscal year ended June 30.]

	State.	Local Community.	Individuals.	Fees.	Farm Products.	Miscellaneous.	Total.
DR.							
To Receipts from other sources than the United States for the year ended.	$....	$....	$....	$....	$....	$....	$3,815 10
CR.							
By Salaries	$....	$....	$....	$....	$....	$....	$803 73
Labor	.....	.....	.....	.....	.....	.....	94 90
Coast Experiments	.....	.....	.....	.....	.....	.....	1,164 20
Registered herd	.....	.....	.....	.....	.....	.....	769 90
Freight and express	.....	.....	.....	.....	.....	.....	.....
Heat, light, water and power	.....	.....	.....	.....	.....	.....	.....
Chemical supplies	.....	.....	.....	.....	.....	.....	.....
Seeds, plants, and sundry supplies	.....	.....	.....	.....	.....	.....	.....
Fertilizers	.....	.....	.....	.....	.....	.....	.....
Feeding stuffs	.....	.....	.....	.....	.....	.....	.....
Library	.....	.....	.....	.....	.....	.....	.....
Tools, implements, and machinery	.....	.....	.....	.....	.....	.....	.....
Furniture and fixtures	.....	.....	.....	.....	.....	.....	.....
Scientific apparatus	.....	.....	.....	.....	.....	.....	.....
Live stock	.....	.....	.....	.....	.....	.....	.....
Traveling expenses	.....	.....	.....	.....	.....	.....	.....
Contingent expenses	.....	.....	.....	.....	.....	.....	.....
Buildings and repairs	.....	.....	.....	.....	.....	.....	.....
Balance	.....	.....	.....	.....	.....	.....	982 27
							$3,815 10

Report of the Vice-Director.

CLEMSON COLLEGE, S. C., October 21, 1904.

Dr. P. H. Mell, Director.

Dear Sir: I have the honor to present herewith material for the annual report of South Carolina Experiment Station for the year ending December 31, 1904. I submit the reports of the chiefs and acting chiefs of divisions, which have been prepared under my general direction.

I take pleasure in stating that efficient work is now being done in all of the divisions. This is materially facilitated by the improved accommodations afforded by the splendid new Agricultural Hall. The presence of the chiefs of divisions in one building renders the administration of the Department of Agriculture very much more satisfactory and effective.

Thanking you for your considerate official cooperation and support in promoting the efficiency of the work of this Department, and in the kindly personal interest which you have manifested in its success.

Very respectfully,

J. S. NEWMAN,
Vice-Director.

REPORT OF THE ASSISTANT AGRICULTURIST.

Prof. J. S. Newman, Vice-Director South Carolina Experiment Station.

Sir: I respectfully submit the following report of the Agricultural Division of the Station for the year ending December 31, 1904:

Wheat, being one of the staple crops of this section, has deservedly received attention on the Station farm for several years past. Believing that the wheat crop has not been as economically fertilized as is consistent with good crops, the ordinary fertilizer test was conducted again this year to aid in getting average results, for a longer period of time, of the different elements of plant food on the crop. In addition, an experiment was conducted with a constant application of phosphoric acid and potash, with variable quantities of nitrogen. A comparative test was conducted as to which is the better mode of planting—in broad, open furrows, or broadcast.

The Durum wheats are being so largely introduced by the United States Department of Agriculture that it was deemed advisable to make a test of the yield of this wheat as compared with one of our best local varieties. The yield of cleaned wheat was much less than that of the local variety. From the result of one year's experiment, we would infer that it would not be a profitable grain crop for this section, but from the hardiness of the plants in withstanding cold, and the comparatively low temperature at which they will grow, it is a promising plant for winter pasture. A test to determine the effect of the three principal elements of the plant food on oats was conducted. Also planting in the broad furrows versus broadcasting.

In the fall of 1903, Edmund Mortimer & Company, of New York, presented the Station with one ton of Peruvian guano, analyzing 3.81 per cent. ammonia, 3.92 per cent. potash, 14.25 per cent. available phosphoric acid, for experimental purposes. This guano was applied at the rate of 500 pounds per acre to oats, wheat, corn, cotton, and sorghum, as compared with an equal amount of plant food furnished by cottonseed meal, acid phosphate, and muriate of potash. Oats and wheat are the only crops that have been harvested to date. It is interesting to note, from one year's experiment, that the Peruvian guano made an increased yield over the Station compound when applied in fall, and that the compounded fertilizer made a slight gain when applied in spring.

Cotton.—For the past five years the work with cotton has been along the line of the improvement of the staple. We now have some crosses that are fairly well established, which possess the prolificness and earliness of the ordinary short staple cotton, and lint practically equal to that of the upland long-staple. This work will be continued in cooperation with the Textile Department. The Agricultural Division will grow the cotton, and do all the field work. The Textile Department will assist in the selection of special stalks, from which to select seed for the next year's planting, and work the lint produced into cloth, noting length of staple, spinning qualities, loss from short fibers, and other points from the manufacturer's standpoint.

Twenty varieties of corn from different States were planted on the Station farm during the past year. This experiment was conducted in cooperation with the Bureau of Plant Industry of the United States Department of Agriculture. The object was to determine the yield of corn from the same variety, when the seed was grown in different States, and to note the change in varietal characters, if any, when grown in this section.

The Willet Drug Company, Augusta, Ga., supplied the Station with Blue Gem watermelon seed, grown in Florida, Georgia, Nebraska, and New Jersey; Florida Favorite, grown in Georgia, Florida, and Nebraska, and Georgia Rattlesnake, grown in Georgia, Florida, and Nebraska, for the purpose of noting any difference in the number, size, and quality of the melons produced from seed grown in the above-mentioned States.

For the past two years the following experiments have been conducted with sorghum as a hay plant: Test of seven varieties, time of planting, amount of seed per acre in drills and broadcast, and fertilizer test.

In the spring of 1903 work, in cooperation with the Chemical Department, was begun with sorghum as a syrup-producing plant. This experiment includes a test of ten of our most common varieties, number of stalks left per acre, time of planting, and the effect of the three principal elements of plant food on the yield of cane-juice and the saccharine content of the juice.

Soil-inoculation experiments were conducted with crimson clover. Inoculating the seed v.s. soil with both local inoculated soils and bacteria prepared by Dr. George F. Moore, Physiologist and Pathologist of the Bureau of Plant Industry, United States Department of Agriculture. Owing to the exceedingly unfavorable winter and spring, crimson clover was a failure this year.

The following hog crops were grown on the Station farm with good results, viz., rape, rye, artichokes, peanuts, chufas, sweet potatoes, cowpeas, and sorghum.

About fifty varieties of cowpeas have been tested this year.

In an effort to get a better sugar cane than sorghum for this section, Japanese sugar cane was secured and tested. The growth has not been satisfactory this year, probably due to the dry autumn.

In 1903 three varieties of truffle oaks were furnished the Station by the Bureau of Plant Industry, United States Department of Agriculture, for the purpose of cooperating later in the development of the famed Truffle in America. *Quercus Ilex* and *Quercus pannonica var pubescens* have all died. *Quercus Robur* is making good growth. By actual measurement, on October 18, 1904, it was found that an extension of twenty inches in length to the upper branches was not an uncommon growth. Dr. David G. Fairchild, Foreign Explorer of the United States Department of Agriculture, recently said that *Quercus Robur* on South Carolina Experiment Station grounds had made better growth than any he had seen in America.

In the spring of 1902 a small area of a badly worn and washed hillside was sown in Black Locust (*Robinia Pseudacacia)* seed. The plants were thinned to about five by eight feet in the spring of 1903, and were cultivated twice a year during the three years of their growth. At the present writing, October 18, 1904, some of the larger trees are about three inches in diameter. The question of supplying posts is getting to be an important item in many sections, and the durability of Black Locust for posts is well known. Growing the plants on the Station grounds was for the purpose of testing the practicability of growing them in this section, and to see if they could be grown on our wasted clay soils.

Preliminary work was begun the past spring, in cooperation with Dr. H. Metcalf, Station Botanist, in the improvement of our common May-pop, with the object in view of making it an economic fruit. Our work has been confined to cultivation and fertilization. So far, marked results have been obtained.

The offspring of three breeds of hogs, viz., Berkshire, Essex, and Poland China, purchased as pigs two years ago, are now sufficient in numbers to begin experiments with the three thoroughbred breeds, and the various crosses obtained. They are

being fed to determine the cost of pork production from each breed and crossbreed.

Respectfully submitted.

H. BENTON,
Assistant Agriculturist.

REPORT OF HORTICULTURIST.

Prof. J. S. Newman, Vice-Director of South Carolina Experiment Station.

Sir: I respectfully submit the following report of the Horticultural Division of the Station for the year ending December 31, 1904.

Apples.—This season forty-five varieties of apples bore fruit, many of which were very fine, and have proven to be well suited to this section of the State. Careful notes have been made on the fruits every year the trees have borne fruit, and notes have also been made as to the condition of the trees from year to year. Some of the varieties have borne fruit regularly every year, while others have a good crop only every other year. Certain varieties have never ripened a crop of fruit, while others planted at the same time (1892) have produced seven crops. The trees were unusually full this year and the apples were smaller than usual. Where the apples were thinned they colored up much better, and were about twice the size of those on the trees that were not thinned.

Spraying experiments to prevent bitter-rot have been conducted for the past five years, and the results show the importance of this work. Seventy per cent. of the Ben Davis apples rotted where the trees were not sprayed, while on the sprayed trees we lost only ten per cent. Eighty-five per cent. of the Kansas Queen apples were destroyed on the unsprayed trees, while we lost only fifteen per cent. on the sprayed trees. Sixty-five per cent. of Carter's Blue rotted on the unsprayed trees, while only fifteen per cent. were destroyed on the sprayed trees. Many of the varieties have shown no signs of the disease at all.

Plums.—Out of the forty varieties of plums, the Wild Goose and Juicy plums were the only ones that produced a full crop.

All of the other varieties were killed by a heavy frost one week after the blooms had dropped. These two varieties are both late bloomers, and for that reason escaped the frost. The trees are in fine condition, and we hope to be able to get notes on these varieties another year.

Grapes.—During the Farmers' Institute we exhibited eighty-four varieties of grapes, all of which were in good condition. This exhibit attracted a great deal of attention, and, judging from the increased number of inquiries received, more interest is being taken in grapes, both for home and market, than ever before.

Notes have been taken on these varieties from the date of blooming to the ripening of the fruit. Marked results have been obtained from bagging these varieties. Some varieties that ripened in August have been kept in good condition in bags until the fifteenth of October, while others would only keep a few days after maturing. Many of these varieties, subject to disease, cannot be grown to perfection unless they are sprayed, while others have been free from disease. Five varieties of European grapes fruited this year, and all but one were kept free from disease by spraying. These grapes have stood three winters without any protection, and I believe they can be grown profitably in this State, if they receive the proper care and attention.

The habit of growth of the many varieties tested varies greatly, and the method of pruning one variety will not apply to all. Certain varieties have given best results when severely pruned, while others have done best when rather long canes were left. A study of the best methods of pruning the varieties best suited to our State will be made. Many of these new varieties of grapes have only fruited one season, and for that reason the test is not yet complete. They will have to be grown several years with success before they can be recommended.

Peaches.—The old peach orchard is fast failing, and, as many of the varieties have proven to be of no value, a good many of the trees have been taken up, and a young orchard set out. This young orchard should bear its first fruit next year. There are a great many varieties of peaches that have been introduced in the last few years, that have not yet been

tested here, as we had no place to plant them. These varieties will, however, be planted this fall. We have secured cions of several valuable varieties of peaches that have not been introduced. We are growing a few trees of these new varieties in order to have them tested in various parts of the State.

Pecans.—Sixty of our seedling pecans bore fruit last season, and only four trees produced nuts of good size. The largest nuts would average sixty-four to the pound, while it would require as many as one hundred and ninety-two to make a pound from other trees. Many seedlings are being planted in this State, and the growers will be greatly disappointed after a number of years to find that the nuts will not be half the size of those they planted. The best varieties now being planted will average from thirty to thirty-five nuts to the pound.

Celery.—We have twenty varieties of celery this year, but on account of the severe drouth we have had during September and October, the plants are not growing as they should. We have been testing these varieties for the last three years, and are now ready to publish the results of our test. We have also tested various methods of blanching celery.

Irish Potatoes.—The following experiments with Irish potatoes have been under way for the last three years:

1. Variety test (twenty-nine varieties).
2. Methods of planting for fall crop.
3. Southern- and Northern-grown seed planted for comparison.
4. Fall and spring planting compared.
5. Experiments in keeping both spring and fall crop.

Variety tests have been made of the following vegetables in addition to those mentioned above: Tomatoes, beets, lettuce, onions, cabbage, cantaloupes, eggplant, cucumbers, spinach, and salsify.

Raspberries and Blackberries.—We are testing a large number of raspberries and blackberries, and after another year's test we will be ready to publish our results.

New varieties of various fruits and vegetables are being introduced every year. We test all these varieties, as far as

possible, so as to be able to advise those making inquiry about them, as to their merits.

I have been greatly assisted in the work of this Division by the efficient services rendered by Mr. Burns Gillison.

Very respectfully,

C. C. NEWMAN,
Horticulturist.

October 21, 1904.

REPORT OF ASSISTANT VETERINARIAN.

Col. J. S. Newman, Vice-Director of South Carolina Experiment Station.

Dear Sir: As per your request, I am submitting a report to you, with reference to experiments, contemplated or in progress, for the year ending December 31, 1904.

First, though, I desire to call your attention to the fact that I am not a member of the Experiment Station staff, which necessarily places me in a very embarrassing position as to stating what the Veterinary Division will do, further than to try to carry out the plans, as I know them, of Dr. G. E. Nesom, whose successor has not been appointed.*

At present, the only experiment in progress is keeping in touch with the two hundred head of cattle, which were inoculated last winter. No conclusion can be derived from, or report made on, this till it is learned whether or not these cattle were rendered immune to Texas Fever, and lived through at least one season of infection. I earnestly hope to see this inoculation of cattle continue, under the supervision of this Station, when it is desired by the cattle owners of the State, so long as they pay the expense of feeding, care, etc., of cattle while undergoing the inoculation.

The work concerning the treatment and prevention of Milk Fever *(Parturient Paresis)* is still in progress, though this is

---

*Dr. Louis A. Klein was appointed Veterinarian October 1st, but did not report for duty until after this report was written.

much delayed owing to the fact that subjects for experiments along this line can only be had as they occur in the College herd, or as the Veterinarian is permitted to see them in the vicinity of the College.

The investigation, as planned, concerning internal parasites affecting sheep will have to be abandoned, owing to the revoking of the appropriation for fencing in inclosures, small barn, etc., by recent act of the Board. This, however, is a subject which I hope to see receive its just consideration in the near future, as it means a great deal to the sheep owners of this State.

At present considerable inquiries concerning a disease in chickens are received by the Veterinary Division. From the reports received, this disease must be somewhat general, and, as there is a great similarity in the reports, I am forced to the conclusion that some systematic and thorough investigation should be adopted whereby the poultry owners of the State could be informed, through a bulletin, of the nature and treatment of this disease. But at present there are no funds available for such investigation.

Also, there is a disease, resembling sore mouth *(Pustula Stomatitis)*, among the dogs of the State, which seems to be contagious, and which, if investigated thoroughly, would be of great benefit to the different kennels throughout the State, as well as to owners of wellbred individuals. Plans as to collecting data concerning this disease, as well as the one existing in poultry, were discussed with Dr. Nesom before his resignation. It was agreed to devote as much time as possible to the subject, though since his resignation my time has been so occupied that it has been impossible to pursue the matter with the system which I had hoped it would receive, although I am still making, as opportunity presents, investigations along this line.

At a recent interview with the assistant in charge of the Animal Husbandry Division, my cooperation was solicited in connection with an experiment proposed in that Division, testing the ill effects of cottonseed meal, if any, as a foodstuff. I heartily acquiesced with the plans of this experiment, and as soon as it can be put into execution, I hope this Division will

be able to contribute to its interest, as well as value, by noting from time to time the physiological condition of animals used as subjects in this experiment.

Respectfully submitted.

A. S. SHEALY,
Assistant State Veterinarian.

October 17, 1904.

REPORT OF BOTANIST AND BACTERIOLOGIST.

Prof. J. S. Newman, Vice-Director of South Carolina Experiment Station.

Dear Sir: I beg to submit the following report:

Correspondence.—The correspondence of this Division has perceptibly increased since the last report. This increase has consisted of letters from teachers in public schools, asking for advice on matters pertaining to Nature Study teaching; and letters from persons interested in their own sanitary surroundings, especially with reference to the matters discussed, and methods advocated, in Bulletin No. 89. It is gratifying to note that my recommendation in an earlier report that Nature Study bulletins be issued, for the use of the teachers in the State, has been favorably acted upon, and that the College will shortly issue a series of such bulletins. This ought to materially decrease the correspondence of this Division, as it will supply much of the information which the teachers now seek through correspondence.

Library.—The library of this Division is still inadequate. As I have previously pointed out, considerable delay in answering correspondence arises from the fact that books for the identification of plants have to be borrowed from other institutions, or from the National Department of Agriculture, before letters can be answered. In my next financial report I shall recommend a small special appropriation to meet this need.

Herbarium.—The number of specimens in the herbarium has been further augmented by collections of economic plants, and of plant diseases. During the ensuing year, the herbarium work will have to largely come to a standstill, as no money is

available for student labor, upon which the work of the herbarium largely depends.

Investigations.—Observations on sanitary conditions of the State have continued, and a bulletin on the subject has been issued. The bulk of my time has, however, been given up to the study of the rice blast. During the winter months I have given all my time to the laboratory study of the fungi associated with the disease. Fertilizer experiments have been undertaken on two plantations on the Cooper River, and one on the Combahee. Since May 1st this work has been in collaboration with the Division of Vegetable Physiology and Pathology of the United States Department of Agriculture. I may add that since June 30th I have been able to put in two months in the fields, and have not only determined to a high degree of probability the cause of the rice blast, but also have found what appears to be a practical method of preventing the disease, at least in those localities where the land is rested. During the coming year this work will be continued, and I shall devote my entire time to it, to the exclusion, if necessary, of the other lines of investigation mentioned in previous reports; as this disease, according to the reports of the planters, has caused a loss in this State of over $1,000,000.00 in the past six years, and is threatening the entire industry. It is very gratifying to realize that in this work I shall have the use of a greenhouse, the need of which I have mentioned in several previous reports.

Respectfully submitted.

HAVEN METCALF,
Botanist and Bacteriologist.

REPORT OF ENTOMOLOGIST.

Prof. J. S. Newman, Vice-Director of South Carolina Experiment Station.

Dear Sir: Since my last report I have had the following insects under observation: woolly aphis, peach borer, harlequin cabbage bug, San Jose scale, plum curculio, codling moth, several species of plant lice, sheep tick, cattle lice, boll worm,

cotton caterpillar, cowpea pod weevil, and red spider. I have also made an effort to secure a cheap, effective, and easily applied insecticide for the peach borer, San Jose scale, sheep tick, and cattle lice, and in several parts of the State I have directed experiments to determine the amount of paris green that may be safely used on peach foliage. Although this work is to be continued, I suggest the publication, in bulletin form, of the notes that have accumulated during the season, as they contain data of value to the farmers of the State.

During August and September, in collaboration with the Bureau of Entomology, United States Department of Agriculture, I gave my time to the study of the insects of rice. I gave particular attention to the water weevil, the rice stalk borer, and the sucking insects affecting the rice heads. The latter was for the purpose of determining to what extent, if any at all, these insects act as agents in the distribution of the disease commonly known as "rotton neck." This work will be placed upon an experimental basis next year, to establish definitely what part insects play in the distribution of this disease.

In the rotation and soil management experiments, proposed by the Agricultural Division of the Station, I will keep accurate record of the insects affecting the plants employed in the experiments. I shall also note the effect of rotation and soil manipulation upon the insects affecting these plants, especially those that are injurious to subterranean parts.

To prepare myself for an emergency that might arise from the escape of the living cotton boll weevils that had been brought into the State through curiosity by many of our farmers, I spent July in Texas, in association with Prof. W. D. Hunter and his corps, studying the habits of this insect and the methods now employed for its control. Upon my return home the large quantity of material, including photographs, which I had collected for illustrating the life history of the cotton boll weevil, was prepared for exhibition and sent to the newspapers of the State. These collections were placed in conspicuous places, and were well advertised by the newspapers that had received them. Many expressions of appreciation for this work have been received, and by request I am now preparing a

bulletin, with illustrations, in which the government work on this insect will be reviewed.

I am still collecting data on cotton insects, with a view of publishing, in the near future, a bulletin containing the life history of these insects, as well as a discussion of the methods used for their control.

Respectfully submitted.

CHARLES E. CHAMBLISS,
Entomologist.

October 10, 1904.

REPORT OF ACTING CHIEF OF DIVISION OF ANIMAL HUSBANDRY AND DAIRYING.

Col. J. S. Newman, Vice-Director of South Carolina Experiment Station.

Dear Sir: Please allow me to submit the following report of the Division of Animal Husbandry and Dairying for the year ending December 31, 1904.

During the months of March and April, 1904, an experiment was conducted to determine the comparative cost of butter produced by Ayrshire and Jersey cows. The test is to be repeated next winter, and Shorthorns and Devons are to be included. When the work has been carried on long enough to enable us to draw conclusions, the total result will be published.

Last spring the Divisions of Entomology and Animal Husbandry did some cooperative work on animal parasites, the object being to determine the most practical methods and substances for farmers to use to remove external parasites. This work will be continued, and results published as soon as possible.

An experiment is now in progress to determine the cost of beef produced by grade Holstein and grade Angus. It is the object of this Division to continue this work, and include in the test the grades of other breeds, as soon as we can get them.

The following experimental work has been planned for the ensuing year:

First. To test the comparative grazing quality of Durum wheat and rye in winter, to determine which will produce the greater quantity and the superior quality at this season.

Second. To begin an experiment to determine, if possible, what injurious effects are produced, if any, by heavy and continuous feeding of cottonseed meal to milch cows. It is desirable to have the cooperation of the Veterinary Division in this work.

Third. To test the comparative feeding value in winter, the keeping quality and the cost of production of each of the following root crops: Sweet potatoes, sugar beets, carrots, and mangel wurtzels. The object of this work is to determine the value of these crops compared with silage for winter feed for cattle, with a view to showing to what extent the small farmer can substitute these crops for silage. The cooperation of the Division of Agriculture is solicited in this work.

Fourth. To again cooperate with the Division of Agriculture in determining the comparative cost of production and feeding value of the following crops: Rye, barley, vetch, oats, and crimson clover, for winter; and pearl millet, German millet, cowpeas, sorghum, teosinte, and corn for summer.

Fifth. To conduct an experiment to determine the cost of production of winter lambs from scrub ewes and pure-bred rams.

Sixth. To cooperate with the Veterinary Division in cleaning the farm of ticks.

Facilities are not yet available for carrying on all of the above named work, but it is our earnest hope that they will be supplied in time for us to begin all of this work during the coming winter and spring.

It is the policy of this Division to increase the amount of experimental work just as rapidly as possible, though at present this work is, to some extent, handicapped on account of limited amount of stock. But the herd and flock are rapidly increasing, and we hope very soon to be able to overcome this difficulty.

We hope, also, very soon to be allowed to begin experimental work with hogs in this Division, for this work, of course, should be included in the Division of Animal Husbandry.

Respectfully submitted.

B. H. RAWL,
Acting Chief of Division.

October 17, 1904.

Report of Chemist.

CLEMSON COLLEGE, S. C., December 27, 1904.

President P. H. Mell, Director.

Sir: I respectfully submit the following report of the Chemical Department of the Station, for the year ending June 30, 1904.

In my last annual report reference was made to the analysis of certain samples of *rice soils* received from Col. J. S. Newman, Vice-Director of the Agricultural Department of the Station, in charge of the Coast Region experiments. It was stated that the soils were found to be very acid, and to contain not only a large quantity of organic acid, but also considerable quantities of aluminium and iron sulphates, and some iron sulphide. It was suggested that lime might prove beneficial to these soils, and the Agricultural Department of the Station undertook a series of pot experiments with one of the soils, using lime at the rate of from 1,800 pounds to 18,000 pounds per acre, the last proportion corresponding with the results obtained in the laboratory by the ammonia test for determining soil acidity. The results of the pot experiments are given in Bulletin 91 of this Station, in the report of Colonel Newman. It appears that, as far as the experiments went, the largest application of lime seemed beneficial. Further tests with lime have been made this year in plot experiments on rice lands, by Dr. Metcalf, the Botanist of the Station, whose reports for this year, and following ones, are looked forward to with much interest. Other work in progress consists in experiments on *sorghum* in cooperation with the Agricultural Department of

the Station. This is a continuation of the investigation begun last year, one bulletin on the subject having been already published. The work is being done by Mr. F. S. Shiver, who reports also that he has completed the investigation of the *Tea Industry* of South Carolina, and nearly finished a study of the *Tobacco Industry* in this State. The results of these investigations will be presented for publication in bulletin form as soon as the manuscripts are ready.

In addition to the foregoing, the following analyses have been made:

1 sample of joint grass for Col. J. S. Newman.
1 sample of soil for Mr. J. G. Murray, Edisto Island, S. C.
2 samples of rice meal for Mr. Thomas Taylor, Jr., Columbia, S. C.
1 sample of cow manure for Mr. Thomas Taylor, Jr., Columbia, S. C.

ANALYSIS OF COMMERCIAL FERTILIZERS.

Following is a report of the work on commercial fertilizers, done under the direction of the Fertilizer Control Committee of the Board of Trustees:

	Season 1902-03.	Season 1903-04.
Official samples	340	402
Farmers' samples	52	125
	392	527

OFFICIAL SAMPLES OF FERTILIZERS.

The number of samples analyzed this year is 402. The analyses are given in full in *Bulletins 87 and 92 of this Station.*

CLASSIFICATION.

	1903.	1904.
Complete fertilizers	139	180
Acid phosphates	51	59
Acid phosphates with potash	55	75
Cottonseed meals	69	57

	1903.	1904.
Kainits	15	11
Nitrate of soda	2	6
Muriate of potash	2	7
Sulphate of potash	1	2
Nitrate of soda with potash	1	0
Ground fish	1	2
Sulphate of ammonia	1	1
Tankage	0	1
Dried blood	1	0
Miscellaneous	2	1
Totals	340	402

DEFICIENT SAMPLES.

Of the 402 samples analyzed, 18 were deficient under the law. In addition to these there were 124 samples which fell below the guarantee in one or more constituents, as follows:

In available phosphoric acid	21
In available phosphoric acid and potash	5
In potash and ammonia	16
In ammonia	40
In potash	42
Total	124

The extent to which they fell below guarantee is shown in the following table:

	Below Guarantee—Per Cent.				
	.0-.10	.10-.25	.25-.50.	.50-1.00	1.00 and Over
In available phosphoric acid	3	13	7	3	0
In ammonia	15	24	14	2	1
In potash	6	28	17	6	6
Total	24	65	38	11	7

The number of samples deficient under the law is smaller this season than last, 18 out of 402, opposite 23 out of 340, or 4.48 per cent. opposite 6.76 per cent.

The number of samples falling below guarantee in one or more constituents, though not deficient in accordance with law, is larger this season than last, there being 124 out of 402 opposite 91 out of 340, or 30.85 per cent. opposite 26.76 per cent.

AVERAGES OF ANALYSES.

	1903. Per Cent.		1904. Per Cent.	
	Found.	Guaranteed.	Found.	Guaranteed.
ACID PHOSPHATES.				
Soluble phosphoric acid	9.77	.....	11.09	.....
Reverted phosphoric acid	3.97	.....	3.23	.....
Available phosphoric acid	13.74	13.23	14.32	13.61
Insoluble phosphoric acid	1.17	.....	.78	.....
Total phosphoric acid	14.91	.....	15.10	.....
ACID PHOSPHATES WITH POTASH.				
Soluble phosphoric acid	6.57	.....	7.33	.....
Reverted phosphoric acid	4.37	.....	3.79	.....
Available phosphoric acid	10.94	10.17	11.12	10.13
Insoluble phosphoric acid	1.26	.....	.82	.....
Total phosphoric acid	12.20	.....	11.94	.....
Potash soluble in water	2.65	2.67	2.81	2.71
COMPLETE FERTILIZERS.				
Soluble phosphoric acid	6.32	.....	6.16	.....
Reverted phosphoric acid	2.70	.....	2.96	.....
Available phosphoric acid	9.02	8.26	9.12	8.27
Insoluble phosphoric acid	1.42	.....	1.50	.....
Total phosphoric acid	10.44	.....	10.62	.....
Ammonia	2.69	2.55	2.99	2.93
Potash soluble in water	2.42	2.14	2.90	2.71
COTTONSEED MEALS.				
Available phosphoric acid	2.27	1.47	2.28	1.54
Ammonia	8.08	7.14	7.92	7.06
Potash soluble in water	1.48	1.00	1.54	1.21
KAINITS.				
Potash soluble in water	12.92	12.00	12.94	12.00
MURIATE OF POTASH.				
Potash soluble in water	50.25	49.00	49.79	49.72
SULPHATE OF POTASH.				
Potash soluble in water	49.32	50.00	53.47	.....
NITRATE OF SODA.				
Ammonia (equivalent)	19.15	18.00	18.87	18.00

The available phosphoric acid and potash in cottonseed meals were guaranteed in only twelve samples, but these ingredients were determined in all cases.

The following table shows the yearly averages of fertilizer analyses from the time the Board of Trustees of this College took charge of the Station work down to the present time:

YEARLY AVERAGES OF ANALYSES FROM 1891 TO 1904, INCLUSIVE.

Season.	Acid Phosphates.		Acid Phosphates with Potash.			Complete Fertilizers.				Cottonseed Meals.				Kainits.		Muriate of Potash.		Nitrate of Soda.	
	Number of Samples.	Available Phosphoric Acid, Per Cent.	Number of Samples.	Available Phosphoric Acid, Per Cent.	Potash Soluble in Water, Per Cent.	Number of Samples.	Available Phosphoric Acid, Per Cent.	Ammonia, Per Cent.	Potash Soluble in Water, Per Cent.	Number of Samples	Available Phosphoric Acid, Per Cent.	Ammonia, Per Cent.	Potash Soluble in Water, Per Cent.	Number of Samples.	Potash, Per Cent.	Number of Samples.	Potash, Per Cent.	Number of Samples.	Ammonia, Per Cent.
1890-1. . . .	49	13.02	19	11.84	1.65	173	9.34	2.68	1.96	30	.....	8.37	.....	21	12.75	1	51.96	1	19.22
1891-2. . . .	29	12.92	16	11.50	1.49	112	8.83	2.80	1.95	25	.....	8.21	.....	18	12.51	.....	.....	1	18.63
1892-3. . . .	48	12.32	26	11.63	1.22	150	9.00	2.91	1.65	20	2.62	8.40	1.32	20	12.05	.....	.....	.....	.....
1893-4. . . .	46	13.24	22	12.01	1.51	132	9.27	2.53	1.79	22	2.45	8.64	1.69	17	12.37	.....	.....	.....	.....
1894-5. . . .	46	13.55	15	12.09	1.66	87	9.42	2.55	1.77	33	2.58	8.19	1.66	19	12.30	.....	.....	.....	.....
1895-6. . . .	42	13.43	26	11.99	1.39	115	9.31	2.64	1.86	34	2.57	8.45	1.61	16	12.45	.....	.....	.....	.....
1896-7. . . .	59	13.61	34	12.06	1.61	117	9.55	2.70	1.91	40	2.53	8.69	1.64	22	12.44	.....	.....	.....	.....
1897-8. . . .	63	13.67	50	11.54	2.06	141	9.15	2.70	1.93	39	2.37	8.39	1.58	20	12.68	.....	.....	1	19.23
1898-9. . . .	73	13.74	68	11.77	1.99	134	9.32	2.73	2.21	40	2.76	8.25	1.75	14	12.78	2	51.93	2	18.96
1899-1900 . .	73	13.58	63	11.58	2.00	124	9.50	2.73	2.13	52	2.27	8.73	1.63	8	12.73	4	50.95	3	19.01
1900-1. . . .	56	14.00	55	11.49	2.65	139	9.40	2.87	2.47	60	2.38	8.55	1.54	12	12.61	2	48.92	3	18.96
1901-2. . . .	45	14.11	51	11.09	2.55	141	9.39	2.84	2.34	49	2.57	7.93	1.63	16	12.85	4	50.54	3	19.03
1902-3. . . .	51	13.74	55	10.94	2.65	139	9.02	2.69	2.42	69	2.27	8.08	1.48	15	12.92	2	50.25	2	19.15
1903-4. . . .	59	14.32	75	11.12	2.81	180	9.12	2.99	2.90	57	2.28	7.92	1.54	11	12.94	7	49.79	6	18.87

In this table the ammonia yielded by the nitrogen in fertilizers is given instead of the nitrogen itself, as in the trade goods are still bought and sold on the ammonia basis. The per cent. of nitrogen is easily calculated, as fourteen-seventeenths of the weight of ammonia is the weight of the nitrogen it contains.

The table shows that there is a continued tendency towards the production of higher-grade goods in the case of acid phosphates and mixed fertilizers, the increase in the percentage of potash being especially noticeable. This is doubtless due to the demands of farmers who are beginning to realize that it is poor economy to purchase low-grade materials.

There has been in general no improvement in the grade of cottonseed meals, the average per cent. of ammonia yielded by the meals being a little lower even than it was during the last two seasons.

GRADES.

In the following table the number of acid phosphates, acid phosphates with potash, and complete fertilizers of each grade, according to guarantee, is placed side by side with the number found by analysis to belong to that grade, fertilizers having commercial values equal to those of schedule grades being classed in those grades:

	High.		Standard.		Low.	
	Claimed.	Found.	Claimed.	Found.	Claimed.	Found.
Complete fertilizers..(180)	83	89	88	86	9	5
Acid phosphates .....(59)	56	56	3	3	0	0
Acid phosphates with potash .....(75)	30	59	45	12	0	4
Total .....(314)	169	204	136	101	9	9

These results are due to the following changes in grades ascertained by analysis:

	Low to Standard.	Standard to High.	Low to High.	High to Standard.	Standard to Low.	High to Low.	No Change.
Complete fertilizers.....(180)	7	9	0	3	3	0	158
Acid phosphates.....(59)	0	3	0	3	0	0	53
Acid phosphates with potash .....(75)	0	25	0	1	4	0	45
Total .....(314)	7	37	0	7	7	0	256

This shows that out of 314 samples, 256 were of the grade claimed for them, 44 were of a higher grade and 14 of a lower grade than that claimed for them.

Last year out of 245 samples, 181 were of the grade claimed for them, 41 were of a higher grade, and 23 of a lower grade than that claimed for them.

FARMERS' SAMPLES OF FERTILIZERS.

In addition to the samples of fertilizers collected by the Official Inspectors, there have been analyzed 125 samples for individual farmers.

WATER.

Fifty-nine samples have been analyzed. Most of them were sent for sanitary examination.

DISTRIBUTION OF THE WORK.

Fertilizers were analyzed by Messrs. C. C. McDonnell and B. F. Robertson; waters by Messrs. McDonnell and D. H. Henry. Dr. R. N. Brackett has aided me in office duties.

Very respectfully,

M. B. HARDIN,
Chief Chemist.

Synopsis of Bulletins.

No. 83, March, 1904. Results of Practical Experiments with Peach Borer. 9 pages.

No. 84, April, 1904. Popular Bulletin, One Horse Farm. 6 pages.

No. 85, April, 1904. Commercial Fertilizers. (1) Summary of Analyses for 1902-1903. (2) Comparison with Results of Previous Years. (3) Remarks on Cottonseed Meal.

No. 86, May, 1904. Tobacco Culture in South Carolina.

No. 87, April, 1904. Analyses of Commercial Fertilizers.

No. 88, May, 1904. Sorghum as a Syrup Plant.

No. 89, May, 1904. Popular Bulletin, Sanitary Conditions in the Home and on the Farm.